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SPIROMETER

DS – Pro 100

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MANUAL BOOK

Foreword

Please read the Manual carefully before using this product. The usage procedures specified in this Manual should be followed carefully. This Manual describes in detail the usage steps that must be observed, procedures that may result in abnormality, and possible damage to the unit or accident to the user. See the next chapter for details. Failure to follow the Manual may result in abnormal measurements, damage to the unit or injury to the user. The manufacturer is NOT responsible for safety, reliability and performance issues of the unit caused by user negligence in use, maintenance or storage. The free service and repair also does not cover such errors.

For product upgrades, the device you receive may not match the description in this Manual, and we apologize for that.

Warning

Before using this product, the safety and effectiveness of the following should be noted:

- Type of protection against electric shock: Class I.
- Degree of protection against electric shock: type BF applied part.
- Working mode: continuous operating device.
- Liquid protection level: IPX0.
- Measurement results must be explained by a qualified doctor and combined with existing clinical symptoms.
- Reliability of use depends on whether the operating manuals and maintenance instructions in this manual are followed.
- The shelf life of this product is 3 years.
- For details regarding clinical limitations and contraindications, please refer to the relevant medical literature carefully.

⚠ **Warning: To ensure safety and effectiveness, please use accessories recommended by our company. Repairs and maintenance must be carried out by professionals approved by our company.**

Operator's responsibility

- The operator must read the Manual carefully before using this product, and carefully follow the operating procedures described in the Manual.
- Safety requirements have been fully considered in product design, but operators should not neglect observing patient and device status.
- The operator must provide information regarding the conditions of use of the product to our company.

Our company responsibility

- Our company supplies quality products to users.
- Our company provides installation, debugging and technical training services according to the contract.
- Our company performs device repairs within the warranty period (one year) and maintenance after the warranty period.
- Our company is responsible for responding to user needs in a timely manner.

Statement

Our company reserves all rights to this unpublished document and reserves the right to maintain the confidentiality of this document. We also endeavor to maintain this document as unpublished copyright. This publication is for reference only for the operation, maintenance or repair of our equipment. No part of this may be disseminated for any other purpose.

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Please read the Manual carefully before using this product. The usage procedures specified in this Manual should be followed carefully. Failure to follow the Manual may result in abnormal measurements, damage to the device and injury to the user. The manufacturer is NOT responsible for safety, reliability and performance issues of the unit caused by user negligence in use, maintenance or storage. The free service and repair also doesn't cover those errors.

Our company has the final interpretation of this manual. The contents of this manual are subject to change without prior notice.

Table of Contents

32	FIT	Forced Inspiration time to reach 100% of FVC	S
33	FIF0.2-1.2	Average inspiratory flow between 0.2L&1.2&Liters of FIVC	L/s
34	MVV	Maximum voluntary ventilation	L/min

10.2 VC

ID	Parameter	Description	Unit
1	VC	Vital capacity	L
2	IC	Inspirational volume	L
3	ERV	Expiratory reserve volume	L
4	IRV	Inspiring reserve volume	L
5	TV	Tidal volume	L
6	RR	Respiratory rate frequency of breathing	Time/min
7	VE	Minute ventilation	L
8	EVC	Expiratory vital capacity	L
9	IVC	Inspirational vital capacity	L
10	tI	Tidal inspirational time	s
11	tE	Tidal expiratory time	s
12	TV/tI	Tidal volume to tidal inspiratory time volume ratio	L/s
13	tI/ttot	Tidal inspiratory time to tidal total respiratory time ratio	

10.3 MVV

ID	Parameter	Description	Unit
1	MVV	Maximum voluntary ventilation	L/min

Chapter 10 Parameter Introduction

10.1 FVC

ID	Parameter	Description	Unit
1	FVC	Forced vital capacity (total expiratory volume)	L
2	FEV0.5	Forced expiratory volume in 0.5 second	L
3	FEV0.5/FVC	FEV0.5/FVC	%
4	FEV1	Forced expiratory volume in one second	L
5	FEV1/FVC	FEV1/FVC	%
6	FEV3	Forced expiratory volume in three seconds	L
7	FEV3/FVC	FEV3/FVC	%
8	FEV6	Forced expiratory volume in six seconds	L
9	FEV6/FVC	FEV6/FVC	%
10	FEV1/FEV6	FEV1/FEV6	%
11	PEF	Peak expiratory flow	L/s
12	ELL	Lung age estimation	year
13	FET	Forced expiratory time to reach 100% of FVC	S
14	FEF25	Forced expired flow at 25% of FVC	L/s
15	FEF50	Forced expired flow at 50% of FVC	L/s
16	FEF75	Forced expired flow at 75% of FVC	L/s
17	FEF2575	Forced expired flow at 25%~75% of FVC	L/s
18	FEF7585	Forced expired flow at 75%~85% of FVC	L/s
19	MET	Time at maximum expiratory flow	S
20	EVOL	Back-extrapolated volume	ml
21	FEF0.2-1.2	Average extrapolated flow between 0.2L&1.2&Liters of FEVC	L/s
22	FIVC	Forced Inspired vital Capacity	L
23	FIF50	Forced inspiratory flow at 50% of FVC	L/s
24	FIF2575	Forced inspiratory flow from 25%~75% of FVC	L/s
25	FIV0.5	Forced inspiratory volume in 0.5 second	L
26	FIV1	Forced inspiratory volume in 1 second	L
27	FIV3	Forced inspiratory volume in 3 seconds	L
28	FIV0.5/FIVC	FIV0.5/FIVC	%
29	FIV1/FIVC	FIV1/FIVC	%
30	FIV3/FIVC	FIV3/FIVC	%
31	PIF	Peak Inspirational Flow	L/s

Chapter 1 Overview

1.1 General

A spirometer is a lung function test device that measures lung volume or flow, which is commonly used in lung function tests. The lung function test is an important test in lung, chest and respiratory physiology, and is an indispensable test in modern lung examinations. This is very important for diagnosis of diseases of the respiratory system, differential diagnosis, evaluation of treatment and determination of surgical procedures. Then, with the rapid clinical development of respiratory physiology, clinical lung function tests are also gaining popularity.

Spirometer is a tool that is lightweight, easy to use and easy to carry. This device can perform measurements of *Forced Vital Capacity* FVC, *Vital Capacity* VC (SVC), *Maximal Voluntary Ventilation MVV and related parameters, display real-time* respiratory waveforms , flow- volume loops and *volume - time* graphs with high accuracy and can be performed over and over again.

1.2 Scope

Spirometer is a portable lung function testing device, mainly used to check lung function related parameters for patients. Can be applied in various environments such as hospitals, clinics, etc. And it is also suitable for communities, schools, factories and other places to carry out epidemiological investigations, health checks, disease screening on a job. The operation of the device does not require special training, the user can operate the device by following the Manual. So the operation of the device will be easy to use.

1.3 Features

1.3.1 Measure the relative functions of *Forced Vital Capacity* (FVC), *Vital Capacity* (VC), *Maximal Voluntary Ventilation* (MVV), test and display more than 30 parameters. For multiple measurements, the optimal result will be displayed. The patient's condition can be seen from the ratio of the measured value and the predicted value.

1.3.2 Measurement parameters:

Forced Vital Capacity (FVC): FVC, FEV1, PEF, (FEV1/FVC), FEF25, FEF50, FEF75, FEF2575, FEV1/VC, FEV6, FEV1/FEV6, ELA, FET, EVOL, FIVC, FIV1, FIV1/FIVC , PIF, MVV, etc

Vital Capacity (VC/SVC): VC, IC, ERV, IRV, EVC, IVC, TV, VE, RR, tI, tE, TV/tI, tI/ttot

Maximal Voluntary Ventilation (MVV): MVV

1.3.3 Displaying a graph of breathing in *real-time* : *Flow – Volume loop* and *Volume – Time curve* ;

1.3.4 7" color LCD with touch screen, buttons can be operated simultaneously with touch screen;

1.3.5 Animated guide as a usage aid, making it easy to use for children and parents;

1.3.6 *Built-in thermal printer* , usage results can be printed directly;

1.3.7 BTPS auto-correction function, compensating for the impact of environmental differences;

1.3.8 Display test time and ambient temperature;

1.3.9 Calibration function, to ensure measurement accuracy;

1.3.10 Multiple predictive values can be selected, according to different populations;

1.3.11 Stores more than 10,000 sets of data;

1.3.12 Lung age estimation function;

1.3.13*Built in lithium battery* , supports AC and DC.

1.4 Main parameters

Volume measurement range: 0 ~ 10 L (FVC)

Volume measurement accuracy: ±3% or 0.05 L (or greater)

Flow rate measurement range : 0~16 L / s

Flow rate accuracy : ±5% or 0.2 L/s (or greater)

Power supply: AC 100V~240V, 50/60 Hz

Input power : 60 VA

LCD Screen: 7 " color TFT display and touch screen

Printing paper : 112 mm(W)×20 m(L) high speed thermal paper

Chapter 9 Packaging and Accessories

9.1 Accessories

When the device leaves the factory, the complete package must contain the following as shown in Table 9:

Table 9 List of Packaging and Accessories

Name	Option
Spirometer	Standard
PFT probe	Standard
Mouthpiece	Standard
Flat Mouthpiece	Optional
Respiratory Filter Mouthpiece	Optional
Nose clip	Standard
Power cable	Standard
USB Cable	Optional
Flashdisk	Optional
User Manual	Standard
Standard Operational Procedure	Standard
Recording paper	Standard
Packing list	Standard
Receiving report	Standard
Packing receipt	Standard
Certification of approval/Warranty card	Standard

9.2 Caution

9.2.1 Follow the instructions when opening the package.

9.2.2 After opening, please check the accessories and accompanying documentation according to the *packing list* , then start inspecting the device.

9.2.3 If the contents of the package do not meet the requirements or the device does not function properly, please contact our company immediately.

9.2.4 Please use the accessories provided by our company, otherwise the performance and safety of the device may be affected. If the accessories provided by other companies need to be used, please consult our company *'s after-sales service first* , or we will not be responsible for the damage caused.

9.2.5 Packages must be stored properly if used during routine maintenance or repair of equipment.

8.8.2 The circuit schematics related to the device and the list of critical components are only available to authorized service or maintenance personnel, the relevant personnel are responsible for the maintenance of the equipment.
8.8.3 Equipment should be calibrated annually (or according to hospital calibration procedures). It is recommended to perform the calibration at a designated national calibration institute or contact our company.

Type of protection against electric shock: *Class I* .
Degree of protection against electric shock: *type* BF *applied part*
Liquid protection level: IPX0.

1.5 Environmental conditions

1.5.1 Work environment
a) Temperature: +10 ℃ ～+40 ℃
b) Relative humidity: ≤80 % RH
c) Atmospheric pressure: 70 kPa ~ 106 kPa
1.5.2 Storage environment
a) Temperature:-40 ℃ ～+ 55 ℃
b) Relative Humidity : ≤ 90% RH
c) Atmospheric pressure: 50 kPa ～ 106 kPa

Chapter 2 Security Notice

2.1 Place the device on a flat surface before use, avoid strong vibration or shock when moving.
2.2 Please use three phase power cord to connect with AC power supply, and the AC power frequency & voltage must be according to the requirements in the Manual. Sufficient frequency capacity must be ensured. If a three-phase power cord is not available, use the internal DC power or replace it with a suitable power cord.
2.3 The unit must be switched off and disconnected from the electrical socket when changing *fuses* , cleaning or sterilizing. Do not use sharp or hard objects to rub the screen.
2.4 Do not use the unit in an environment with strong electromagnetic interference, direct wind sources, cold sources and heat sources.
2.5 Recommended indoor use. Excessive ambient light can affect measurement accuracy. This includes fluorescent lamps, double ruby lamps, infrared heaters, direct sunlight, etc.
2.6 Please do not operate this device in an environment containing flammable anesthetic gases or other flammable chemicals, as this may cause an explosion or fire.
2.7 Keep the device away from dust, vibration, corrosive substances, flammable substances, high or low temperature and humidity.
2.8 When the device is brought from a cold environment to a warm or humid environment, please do not use it immediately.
2.9 The device cannot be used in conjunction with a device not specified in the Manual. Only accessories specified or recommended by the manufacturer may be used with this device.
2.10 Disposal of waste materials and their accessories and packaging (including funnels, plastic bags, foam and paper boxes, etc.) must comply with local laws and regulations.
2.11 This product has been calibrated before leaving the factory.
2.12 The device should be calibrated regularly at least once a year.
2.13 In order to get the best results, the measurement of each parameter by the device must be operated correctly according to the Manual.
2.14 EMC Declaration

- When this device is installed or used, EMC must be considered, as portable and mobile RF communication equipment that generates high EM interference may affect this unit.
- The internal components and cables should not be changed, as this may degrade the performance of the device.
- The device must not be used adjacent to or stacked with other equipment.

- **Keep the battery away when it appears that the battery leaks or emits a strong odor. If battery electrolyte leaks onto skin or clothing, wash it off immediately with water. If the electrolyte accidentally gets into the eye, do not rub the eye, clean it with water and consult a doctor immediately.**
- **If the battery reaches life, smells, is deformed, discolored or abnormal, stop using the battery and follow local regulations for waste treatment.**

8.2 Recording paper

To obtain high-quality prints of test data and *waveforms* , use the high-speed thermal recording paper supplied or specified by our company. If using other types of *printing paper* , the following problems may appear, such as *waveform* blur, paper blur, paper *printing process* is not smooth, etc. Or even speed up the wear process, or shorten the life of components including the *print head* . Please consult the distributor or manufacturer for an explanation of how to purchase paper.
8.2.1 When selecting *print paper* , never choose paper with a waxy, gray or black surface, otherwise the wax will stick to the *print head heating unit* , causing abnormality or damage.
8.2.2 Damage to *printed paper* can be affected by high temperature, humidity or direct sunlight. For long storage, *printing* paper should be placed in a dry, dark and cool place.
8.2.3 Do not place the *printing paper* under a fluorescent lamp for a long time, because the *print quality* will be affected.
8.2.4 Do not store *printing paper* with PVC plastic, because the paper will fade.
8.2.5 Pay attention to the specifications of the *printing paper* when using, *printing paper* that does not meet the requirements can cause damage to the *thermal print head* (TPH) or silicone rubber rollers.

8.3 Care after use

8.3.1 Press and hold the button  to turn off the device.
8.3.2 Disconnect the power cable and the spirometer connecting cable (PFT probe). Hold the plug head to release the cable. Do not pull the cable directly.
8.3.3 Clean the device and accessories, cover to avoid dust.
8.3.4 Store the device in a cool and dry place, avoiding strong vibrations when moving.
8.3.5 When cleaning the device, do not immerse the unit in the cleaner. The power supply must be disconnected before cleaning. Use neutral detergent for cleaning. Do not use detergents or disinfectants that contain alcohol.

8.4 Cleaning and Disinfection of the spirometer (PFT probe)

First, wipe the spirometer (PFT probe) with medical alcohol, then air dry or use a soft clean cloth to dry. To maintain the accuracy of the turbine, it must be cleaned regularly. Maintain the transparency of the transparent parts of the turbine, making sure that there are no foreign objects (such as hair or deposits of small objects, etc.) in the turbine. The turbine must be disinfected after use. Soak in the detergent solution for a few minutes, then take it out, wash it with water (don't rinse the turbine directly with water), then dry the turbine. Disinfection will not cause environmental pollution. (Note: The disinfectant is 75% medical alcohol.)

8.5 Cleaning the thermal print head

Dirt and dust on the surface of the TPH can affect the clarity of the *waveform recording* . To clean the surface of the *print head* , open the paper cabinet cover after turning off the device, use a clean, soft cloth dampened with alcohol to gently wipe the surface. For the remaining stains on the *print head* , wet it with a little alcohol first, then wipe it with a soft cloth. Never use a hard object to scratch the surface, otherwise the *print head* will be damaged. Do not close the paper cabinet cover until the alcohol has evaporated. Clean the *print head* at least once a month during normal use.

8.6 Disposal of residual products

Please comply with local laws and regulations for the disposal of product waste, including packaging materials, battery and product waste, and try to follow classification and recycling.

8.7 Others

8.8.1 Do not open the cover of the device, as this may cause an electric shock hazard.

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Chapter 8 Maintenance

8.1 Battery charge, battery level and replacement

8.1.1 This device is designed with a *built-in sealed maintenance-free rechargeable lithium battery , and has an automatic charging* and *discharging* monitoring system . When using AC power supply, and turn the unit's *power switch* to "ON", then the battery can be charged automatically. The LCD screen will show the current power status in the upper right corner when the unit is on, as shown in the following table. It takes about 4 hours for a full charge after being completely discharged.

Table 8 Battery charge and level display

No.	Symbol	Description
a		Using AC power supply, and the battery is charging
b		Using AC power, and the battery is fully charged or no battery is installed
c		Using the battery, and the battery is full
d		Using battery, battery level:
e		Using battery, battery level:
f		Using battery, battery level:
g		Using the battery, the battery is running low, it is recommended to recharge the battery or use AC power supply

8.1.2 In *standby mode* , the device can continue to work for 4 hours after the battery is fully charged. When working, the LCD screen displays the battery status symbol in 5 levels.

8.1.3 Batteries must be recharged timely after they are fully discharged. For long-term storage, the battery must be recharged every 3 months, to significantly extend battery life.

8.1.4 If the battery is non-rechargeable or functioning no more than 10 minutes after being fully charged, please replace the battery.

⚠ **Warning:**

- **Do not try to disassemble the battery. If necessary, let the professional personnel authorized by our company replace the battery. The same model of rechargeable battery provided by our company should be used.**
- **Do not directly connect the "+" and "-" poles of the battery with wires, as this may cause a fire.**
- **Do not use the battery near sources of ignition or in an environment over 60 °C, do not heat the battery or dispose of it in fire or water, and keep it from getting wet.**
- **Do not puncture, hammer, strike or destroy the battery in any other way, as this will cause overheating, smoke, deformation or fire, and a hazard.**

Chapter 3 Maintenance Regulation

3.1 Under normal use conditions according to the Manual and operating notices, if this unit has any problems, please contact our *customer service* . Our company has sales records and customer records for each unit. Customers are offered free warranty service within one year from the date of purchase. In order to provide our customers with thorough and fast maintenance service, please send us the warranty card in time.

3.2 Our company adopts several ways to provide usage instructions, send to the company by courier, visit the customer's company, etc. to carry out maintenance services.

3.3 Within the free maintenance period, we may charge for repairs in the following situations:

3.3.1 Errors or damage caused by neglect of the User Manual and instructions for use.

3.3.2 Error or damage caused by accidental drop while moving the device after purchase.

3.3.3 Errors or damage caused by repair, reconstruction or decomposition, etc. by other parties except our company.

3.3.4 Errors or damage caused by improper storage or *force majeure* after purchase.

3.3.5 Errors or damage caused by the use of inappropriate thermal *recording paper.*

3.4 The free maintenance period for worn accessories and spare parts is half a year. Power cord, recording paper, operating instructions and packaging are not included.

3.5 Our company is not responsible for any other connecting instrument fault caused by the fault of this unit directly or indirectly.

3.6 Free maintenance service is only provided when the protection label is complete.

3.7 For maintenance costs beyond the warranty period, our company recommends continuing to use the "Regulation of the maintenance contract". Please consult our *customer service department* for specific situations.

Chapter 4 Principles and Characteristics of Structure

4.1 Principle

user should keep *the mouthpoece* in the mouth, then inhale or exhale for different test functions. The inhaled/exhaled air passes through the turbine section to the *rotary airflow* and drives the blades to rotate. The infrared emitting tube and the receiving tube inside the Spirometer are parallel to the blade section, when the blade rotates, the infrared receiving tube receives light of different intensities, generates a variable signal, and then is processed by processing into an MCU identifiable signal. The MCU processes and analyzes the data, then it is sent to the main unit to be calculated in *real-time* . Then the measured parameters and the corresponding waveform will be displayed on the screen.

4.2 Parts and functions

4.2.1 Front view

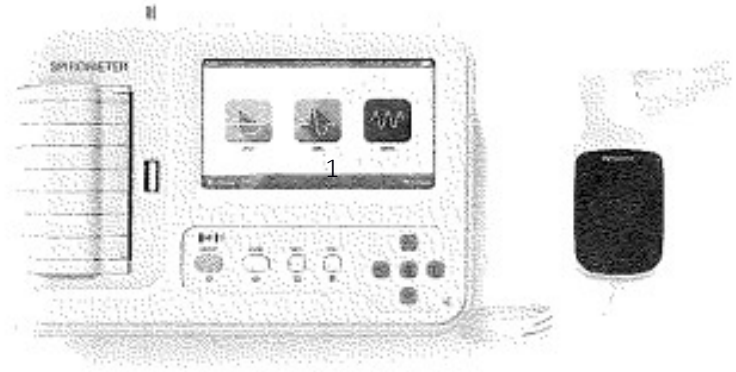

Figure 4-1 Front view

1、*Paper Cabinet Cover*
Keep the *paper cabinet* closed, hold the *print paper* .

2、Screen Display
Displays data and *waveform* .

3、*Probes*
Receive data from *user* , then send data to main unit.

4、*Control Panel*
Control device operation and enter information.

⚠ Warning

- **Do not overload the screen or impact it, otherwise the screen will be damaged.**
- **Pack the unit or cover it when not in use, to avoid the possibility of liquid spilling on the screen.**
- **Do not use sharp objects to operate the buttons, as this may cause permanent damage.**

Chapter 7 Troubleshooting

Failure	Reason analysis	Solution
After a long wait, the test did not finish, and there was no data display	The device did not start the test because the initial speed was low.	Test once again according to the *user manual* .
	Device failure, test cannot be performed.	Test again or *restart* the unit.
Image is not normal and irregular	The communication error is caused by an improper shutdown of the unit.	Test again or *restart* the unit.
	Incorrect operation.	Follow the *user manual* to operate.
	Device failure.	Please contact *customer service* .
Misscommunication	Failed to establish connection	Reconnect the USB cable or *restart* the unit.
	The main unit or spirometer (PFT probe) may be faulty.	Please contact *customer service* .
The device cannot be turned on.	*power* cable is loose or may be broken.	*power* cable or replace it with a new one.
	The battery is low or depleted.	*charge* .
	The device may be damaged.	Please contact your local customer service center.
The battery drains quickly after charging.	The battery is not fully charged.	*charge* .
	The battery may be damaged.	Please contact *customer service* .
The battery is *charged* for more than 10 hours, but still not fully charged.	The battery may be damaged.	Please contact *customer service.*

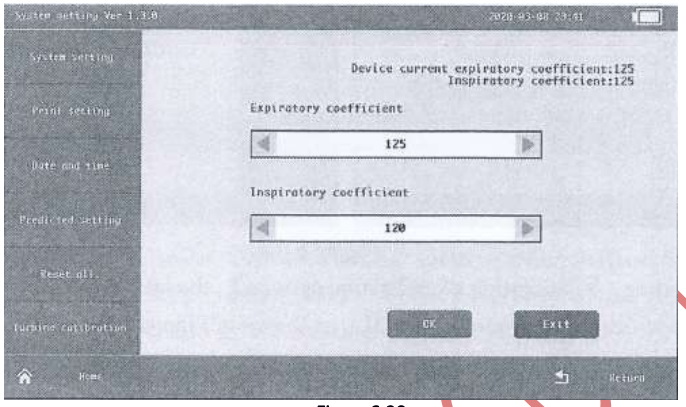

Figure 6-20

Click " "" To change the *inspiration coefficient* and *expiration coefficient* . Click " " once, the value of the selected coefficient decreases by 1, click " " once, the value of the selected coefficient increases by 1. After that, click 【OK】 to confirm the change, the *interface* is as shown shown in Figure 6-21 will appear, then click 【OK】 again, the system will display "Coefficient calibration successful! ".

Note: Modification of the calibration coefficient will directly affect the accuracy of the test results, please note.

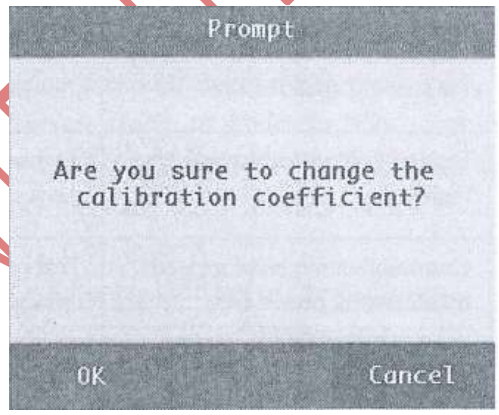

Figure 6-21

4.2.2 Side view

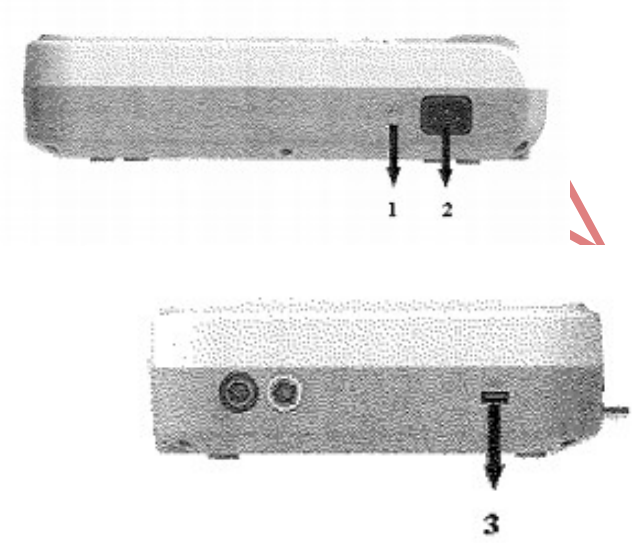

Figure 4-2 Side view

1. Equipotential terminal: connect with *ground wire*
2. Input jack: connect with AC power cord
3. USB *interface* : connect with probe.

4.2.3 Control panels

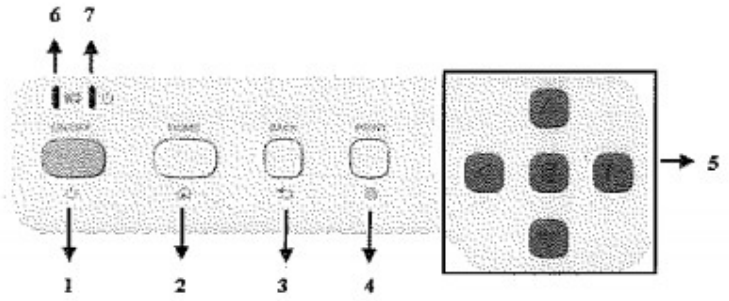

Figure 4-3 *Control panel*

1, *ON/OFF*
Press and hold the button to turn on the unit; once turned on, press and hold the button again to turn off the unit.
2, *HOME*
In any *interface* , pressing the "HOME" button will immediately open the menu.

3, *BACK*
Return to the previous *interface* .
4, *PRINT*
Print the data and the resulting waveform.
5, *Direction keys*
Up/down, left/right button operation and OK function, convenient and efficient.
6, *Power status indicator*
The green indicator shows AC power supply, it means the device is not connected to the battery or the battery is full; the red-green indicator shows that the device is *charging* .
7, *Startup indicators*
The indicator will turn green once the device is turned on.

4.2.4 Meaning of symbols

Symbol	Definition
	Please be careful, see the Manual
	WEEE (2002/96/EC)
	*Type* BF *applied part*
	Disposable
	Storage atmospheric pressure
	Storage temperature
	Storage humidity
	*Fragile*
	This side is facing up
	Beware of getting wet
	Serial number

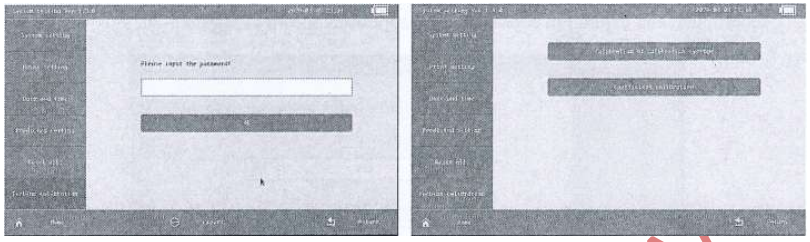

Figure 6-18

- After selecting 【Calibration of calibration syringe】, the *interface* will display the "Scaler specification" option (2L or 3L optional), as shown in Figure 6-19.

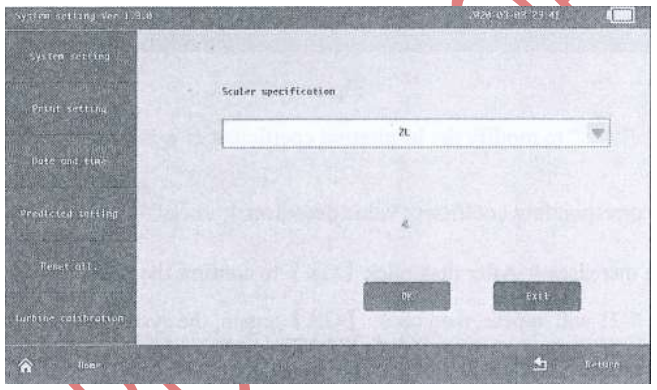

Figure 6-19

Select the appropriate scaler specification, then click 【OK】 to start calibration. Please follow the instructions from the system command "Please push the syringe, then pull!"

- ❖ Calibration is complete in 60 seconds, otherwise the system will display "Over time, please calibrate again!".
- ❖ When calibration is completed for the first time, the system prompts "Please press 'OK' button to repeat the above operation, continue calibrating!".
- ❖ Then proceed to calibrate once again, if successful, the system will display "Calibration succeed!".
- ❖ If the spirometer (PFT probe) is not properly connected, the system will display "Connection error!".
- ❖ If the scaler does not match the *software* , the system will display "Please select a right scaler!".
- ❖ If the error is too large during the calibration process, the system will prompt "Please change the blade!".

- After selecting 【Coefficient calibration】, the *interface* to change *the inspiration coefficient* and *expiration coefficient* will appear, as shown in Figure 6-20.

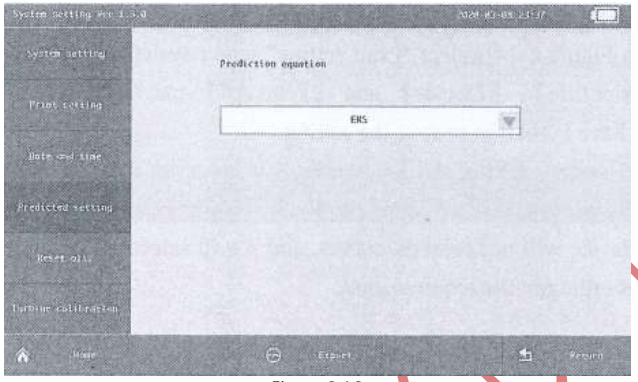

Figure 6-16

6.6.5 Reset all

In the system settings *interface* , select "Reset all", the system will display "Are you sure to reset all?". Click 【OK】 to return all settings to their original state. Click【 Cancel】 to cancel, as shown in Figure 6-17.

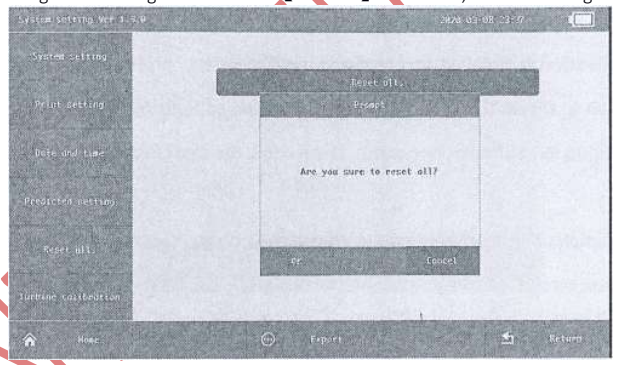

Figure 6-17

6.6.6 Turbine calibration

On the system setup *interface* , select "Turbine calibration", then two options 【Calibration of calibration syringe】 and 【Coefficient calibration】 will be displayed, as shown (passowrd 8888) in Figure 6-18.

Chapter 5 Preparation before Operation

5.1 Installation of recording paper

5.1.1 This device adopts high speed thermal *recording paper , specification 110mm(W)×20m(L).*

5.1.2 Installation

1、Slide the paper cabinet cover switch to the left, lift the cover, and remove the paper roll. Install the *recording paper* in the paper cabinet. Note that the side with the *gridlines* should be facing down, then place the roll of paper back into the paper cabinet properly.

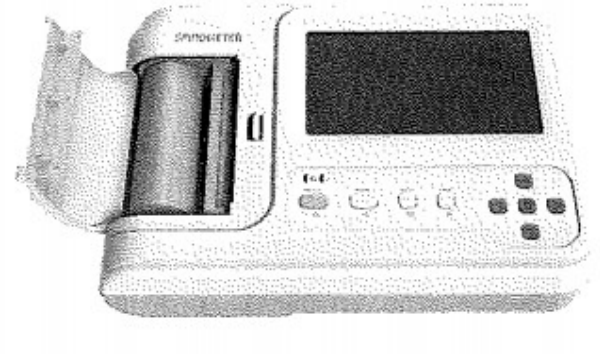

Figure 5-1

2、Pull out the recording paper through the available slot, close the cover.

5.1.3 During the printing process, when the *recording paper* runs out, the device will stop printing and a paper out notification will appear on the LCD screen.

5.2 Installation of spirometer (PFT probe)

1. Use a USB cable to connect the spirometer main unit to the *probe* .
2. Attach the *mouthpiece* to the turbine *port* of the spirometer (PFT probe), as shown in Figure 5-2.

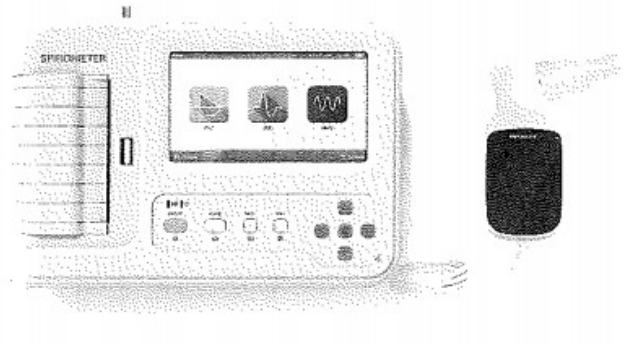

Figure 5-2

5.3 Connection with power supply

5.3.1 AC power supply

Insert the 3-phase cable into the *input jack* on the device, and the other end into the required standard three-phase socket, make sure the connection is secure, then the unit will be *grounded* automatically.

5.3.2 Battery

This device is designed with a *built-in rechargeable lithium battery* , so users do not need to install batteries. Before use, make sure the battery is in good condition with sufficient power.

6.6.2 Print settings

As shown in Figure 6-14, select " *Print setting* " in the system settings *interface* . 【Hospital】, 【Print title】, 【Doctor】 and 【Print all】 options can be modified. After all the items are changed, click the 【Save】 button to save the settings.

Select "Yes" on the Print all *interface* , this indicates that the unit will print three optimal curves and a comparison curve before/after drug consumption (if any). Selecting "No" indicates that the device will not print all curves, and will select the curves to be printed on *the review interface* as desired.

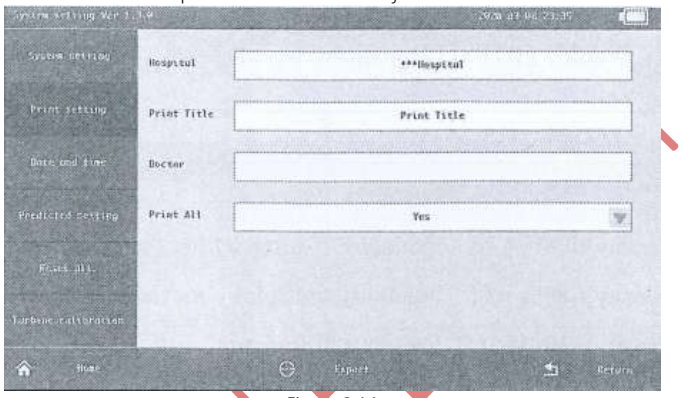

Figure 6-14

6.6.3 Setting the date and time

As shown in Figure 6-15, select "date and time" in the system settings *interface* . The year, month, day, hour, minute and second options can be changed. After all the items are changed, click the 【Save】 button to save the settings.

Figure 6-15

6.6.4 Predicted settings

As shown in Figure 6-16, select "Predicted setting" on the system *interface* . Prediction value options including 【ERS】, 【Knudson】, 【USA】 can be changed. After all the items are changed, click the Save】 button to save the settings.

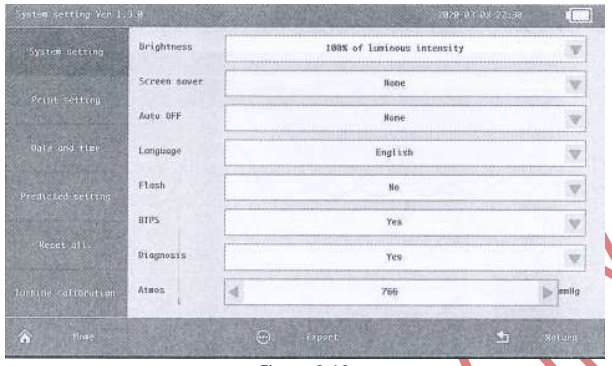

Figure 6-13

In this *interface* , options including 【Brightness】, 【Screen saver】, 【Auto power off】, 【Language】, 【Flash】 can be modified. See the following table for details:

Options	Optional content	Description
Brightness	[40% light intensity] / [60% light intensity] / [80% light intensity] / [100% light intensity]	After adjusting the brightness, the screen will be displayed in a certain level of backlight intensity.
Screen saver	[None] / [30 sec] / [1 min] / [2 min] / [5 min] / [10 min]	If there is no change in the timing, the backlight will turn off. If you select "None", the backlight will not turn off.
Auto power off	[None] / [1 min] / [3 min] / [5 min] / [10 min] / [15 min] / [30 min] / [60 min]	If there is no change in the timing, the unit will turn off automatically. If you select "None", the device will not turn off automatically.
Language	[Chinese] / [English]	System default language
Flash	[No] / [Yes]	Flash will not appear during the testing process.
BTPS	[No] / [Yes]	Temperature compensation
Diagnosis	[No] / [Yes]	To see the results of the analysis
Atmos		Atmospheric Pressure
Export		

After all the items are changed, click the 【Save】 button to save the settings.

Chapter 6 Operating Instructions

6.1 Create new patient data

（1）After the installation is complete, press and hold the ON/OFF button to turn on the device. You will hear a "Beep" sound, and the unit indicator will turn green. During this process, the device will display " Loading... " until the system enters the MENU *interface* , as shown in Figure 6-1.

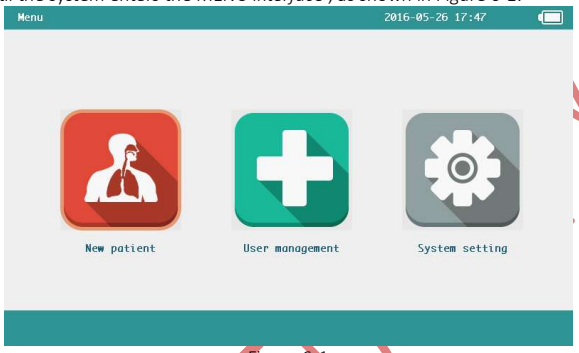

Figure 6-1

（2）On the MENU *interface , click* " " to enter the " *New Patient* " *interface* , as shown in Figure 6-2.

Figure 6-2

（3）Enter patient information, such as name, race, gender, age, etc.

- ***Input name*** **:** move your finger to editable area, virtual *keyboard* will appear automatically, then tap to *input* a word, as shown below:

Click 【全拼】or 【EN】 to switch the language between Chinese and English.

Click " " to hide the text input section from the virtual *keyboard* , click again to show.

Click " " to close the virtual *keyboard* , or click a non- *keyboard area* on the screen to close it.

Drag an empty area above the virtual *keyboard* to move it.

- **Patient information settings (race, gender, age, height, weight, smoker, drugs, etc.)**

On the " *New patient* " *interface* :

Click " " to select race, gender, smoker and drug.

Click " "" to change age, height and weight. Click " " once, to increase 1 number, click " " once, to decrease 1 number.

（4）After all items are set, click the 【Save】button, then enter the *quick test interface* , as shown in Figure 6-3. Click FVC / SVC / MVV to perform the appropriate test.

Figure 6-3

6.2 Testing

6.2.1 FVC Test

（1）In the *quick test interface* , click " " to enter the FVC testing *interface* , then the user can choose whether to tick the 【Drug】 button according to the condition of the drug being consumed, as shown in Figure 6-4.

Figure 6-11

6.5.3 MVV review

The steps are similar to the FVC review Section 6.5.1, and will not be described further in this section.

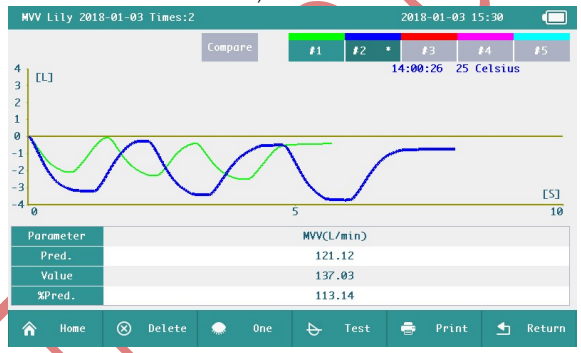

Figure 6-12

6.6 System settings

6.6.1 System settings

On the MENU *interface* , click " " to enter the system setup *interface* , as shown in Figure 6-13.

(2) Click the 【Delete】 button, the unit will display "Are you sure to delete the case selected?", click 【Delete】 to continue and click Cancel】 to cancel.

(3) 【Test】 includes options 【FVC】, 【SVC】, 【MVV】, 【 Close】. Selecting test will execute the selected test function.

(4) Click 【View】 to enter the *waveform & parameter preview interface* , as shown in Figure 6-10, Figure 6-11, Figure 6-12.

6.5 Data Review

6.5.1 FVC Review

Figure 6-10

(1) Double-click on the *waveform area* shown in Figure 6-10, the parameter list will be hidden, and the *waveform* will be enlarged in full view. Double click the *waveform area* again, the display will return to normal.

(2) Click " " to view the next page in the parameter list, then click " " to view the front page.

(3) 

a number with a green background represents the test data, and a number with a gray background means that there is no test data yet. Numbers marked with "*" represent testing after taking the drug, numbers without "*" representing testing before taking the drug. When a number with a green background is selected, the corresponding *waveform* will be displayed in bold.

Click 【Compare】 to select two optimum *waveforms* and data before/after drug consumption to compare (if any).

Click 【Delete】 to delete the selected item.

Click 【One】 to display one *waveform* .

Click 【All】 to display all *waveforms* in one view.

Click 【Test】, it will appear 【FVC】, 【SVC】, 【MVV】, 【Close】. Selecting test will run the test function according to the selected function.

Click 【Print】 to print the report. See "6.6.2 Print settings" for details.

6.5.2 SVC review

The steps are similar to the FVC review Section 6.5.1, and will not be described further in this section.

Figure 6-4

（2）At the FVC testing *interface* , insert the *mouthpiece* into the patient's mouth, exhale as hard as possible: exhale all the air in the lungs as quickly as possible, then inhale strongly: inhale as many breaths as quickly as possible in short intervals of time. This process can be repeated. The system will draw the test result *waveform in real-time* . Remove the *mouthpiece* from the mouth, the system will automatically switch to the *case management interface* , and the system will select the most optimum value to display, as shown in Figure 6-5.

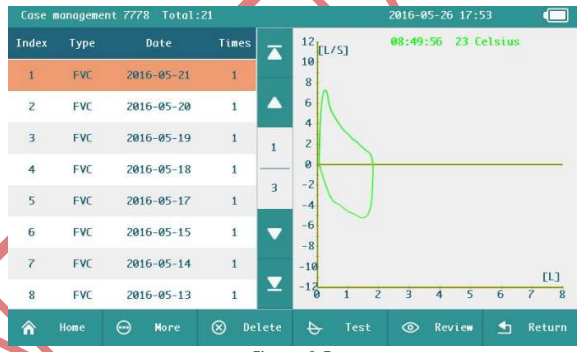

Figure 6-5

6.2.2 SVC Test

(1) In the *quick test interface* , click the " " button to enter the SVC testing *interface* , then the user can choose whether to tick the 【Drug】 button according to the condition of the drug being consumed.

(2) On the SVC testing *interface , place the mouthpiece* in the patient's mouth, exhale relaxedly at least 4 times through the mouth, when it appears on the screen, take a deep breath to the maximum lung volume (inhale deeply as much as possible), then exhale all the air to the residual volume (exhale as much as you can). The system will display the test result *waveform in real-time* , as shown in Figure 6-6. remove the *mouthpiece* , the system will stop the testing process automatically and switch to the *case management interface* .

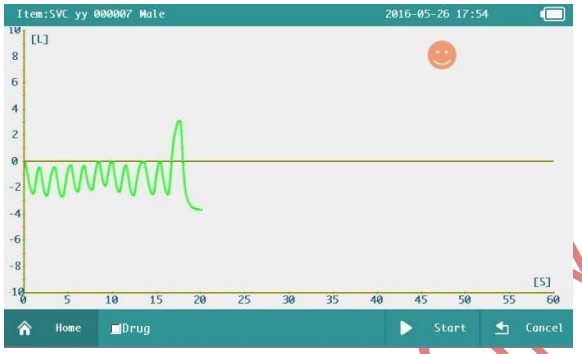

Figure 6-6

（3）When appears on the screen, it means the test is invalid, please retest.

6.2.3 MVV Pengujian Testing

(1) On the *quick test interface* , click the " " button to enter the MVV testing *interface* , then the user can choose whether to tick the 【Drug】 button according to the condition of the drug being consumed.

(2) Place the *mouthpiece* on the patient's mouth, inhale and exhale rapidly and constantly for 12 seconds, the system will draw the test result *waveform* in real-time, as shown in Figure 6-7. Remove the *mouthpiece* , the system will automatically switch to the *case management interface* .

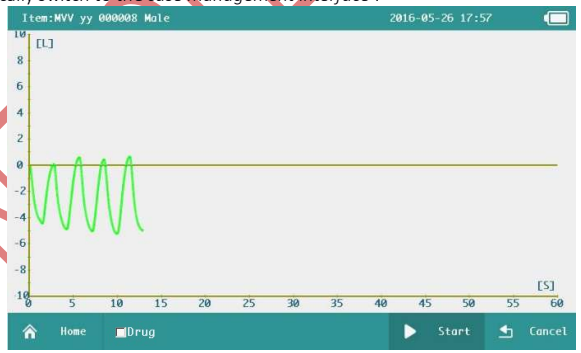

Figure 6-7

6.3 User Management

In the MENU *interface , click* " " to enter the *user management interface* , as shown in Figure 6-8. The system will display all the data stored on the unit. In this *interface* , users can modify, search, delete test information and review functions . .

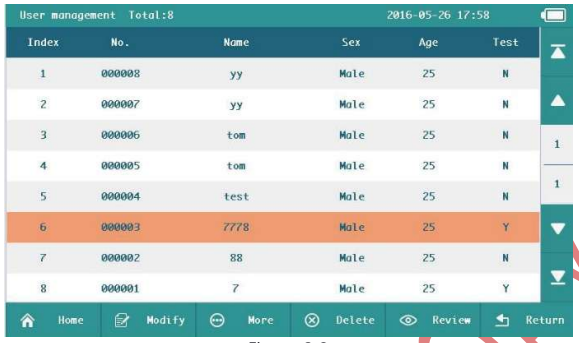

Figure 6-8

Note: "Y" represents no test data, "N" represents no test data.

(1) Click the 【Modify】 button to enter the *user information modification interface* . For operations on these *interfaces* , see Section 6.1 for details. After all the items are changed, click the 【Save】 button to save the settings.

(2) 【More】 contains *options* 【Search】, 【 All】, 【Delete All】, 【Close】.

- Click 【Search】 to enter the patient search *interface* .
- Click 【All】 to switch from search *interface to user management interface* .
- Click 【Delete All】, the unit will display "Are you sure to delete all patient information and cases?", Click 【Delete】 to continue and click 【Cancel】 to cancel.
- Click 【Close】 to close the *option* .

(3) Click the 【Delete】 button, the device will display "Do you want to delete the patient information selected?", click 【Delete】 to delete the selected item and click 【Cancel】 to cancel.

(4) Click the 【Review】 button to enter the *case management interface* , and view the patient test *waveform* and the test day, as shown in Figure 6-9.

Figure 6-9

6.4 Case Management

In the *case management interface* shown in Figure 6-9:

(1) 【More】 there are options 【Search】, 【All】, 【Delete All】, 【Close】. Operations like search case, show all data, delete all data, etc can be performed.